

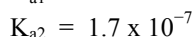
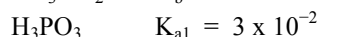
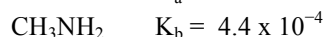
Practice Test Ch 15

- This is practice - Do NOT cheat yourself of finding out what you are capable of doing. Be sure you follow the testing conditions outlined below.
- For MC, DO NOT USE A CALCULATOR. You may use ONLY a periodic table.
- Try to work at a pace of about 1.2 min per MC question. Time yourself. You know how important it is that you practice working for speed. Use 15 minutes per FR.
- Then when time is up, continue working without a calculator.
- After you have completed as many as possible without the calculator. Finish with a calculator as necessary.

The next 8 questions refer to the following descriptions of chemical solutions.

- (A) a solution with $\text{pH} = 7$
- (B) a solution with a $\text{pH} < 7$ which is not a buffer
- (C) a solution with a $\text{pH} < 7$ which is a buffer
- (D) a solution with a $\text{pH} > 7$ which is not a buffer
- (E) a solution with a $\text{pH} > 7$ which is a buffer

Ionization constants



(Contrary to the appearance of its formula, phosphorous acid is diprotic, not triprotic.)

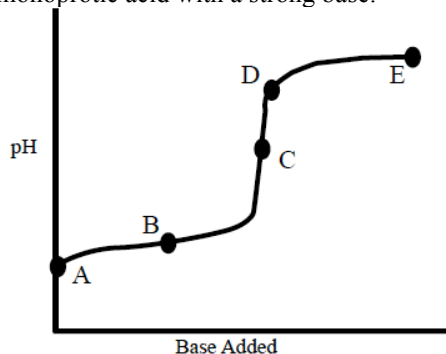
1. A solution with an initial KCOOH concentration of 1 M and an initial K_2HPO_3 concentration of 1 M. Equal volumes of both solutions mixed together.
2. A solution with an initial H_3PO_3 concentration of 1 M and an initial KH_2PO_3 concentration of 1 M. Equal volumes of both solutions mixed together.
3. A solution with an initial CH_3NH_2 concentration of 1 M and an initial $\text{CH}_3\text{NH}_3\text{Cl}$ concentration of 1 M. Equal volumes of both solutions mixed together.
4. A solution made of equal volumes of 0.5 M CH_3NH_2 and 0.25 M HCl
5. A solution made of 10 ml of 0.1 M H_3PO_3 and 20 ml of 0.1 M NaOH .
6. A solution made of 20 ml of 0.1 M HCl and 10 ml of 0.1 M NaOH
7. A solution made with 0.10 M NaCl
8. A solution made with equal volumes of 0.5 M KOH and HNO_3

The next 4 questions refer to the following descriptions of equal quantities of each aqueous solution mixed together in which each of the two species listed have concentrations of 1 M.

- (A) $\text{H}_2\text{C}_2\text{O}_4$, oxalic acid and KHC_2O_4 , potassium hydrogen oxalate
- (B) KNO_3 , potassium nitrate and HNO_3 , nitric acid
- (C) NH_3 , ammonia and NH_4NO_3 ammonium nitrate
- (D) $\text{C}_2\text{H}_5\text{NH}_2$, ethylamine and KOH , potassium hydroxide
- (E) HCl , hydrochloric acid and KOH , potassium hydroxide

9. The most acidic solution.
10. The solution with pH closest to 7
11. A buffer with $\text{pH} > 7$
12. A buffer with a $\text{pH} < 7$

The diagram below shows the titration of a weak monoprotic acid with a strong base.



13. At this point in the titration the pH of the solution is equal to the pK_a of the acid.
14. This is the equivalence point of the titration.
15. Of the points shown on the graph, this is the point at which the most excess base has been added
16. At this point the solution is a balanced buffer.

17. The K_a of hypochlorous acid (HClO) is 3.0×10^{-8} at 25.0°C . Calculate the pH of a 0.030 M hypochlorous acid solution.
- 8.30
 - 7.54
 - 5.30
 - 4.52
 - 3.00
18. The K_b of hydroxylamine, HONH_2 is 1.0×10^{-8} at 25.0°C . What is the pH of 100 ml of 0.050 M aqueous solution of hydroxylamine, to which 0.35 g of hydroxylamide chloride, HONH_3Cl has been added? Assume no volume change to the solution.
- 4
 - 6
 - 7
 - 8
 - 10
19. A buffer that has ten times as many moles of lactic acid as moles of sodium lactate has a pH of 5.0 , what is the K_a for lactic acid?
- 1×10^{-4}
 - 5×10^{-4}
 - 1×10^{-5}
 - 2×10^{-5}
 - 1×10^{-6}
20. Calculate the pH of solution made by combining 100.0 ml of $0.28\text{ M HC}_2\text{H}_3\text{O}_2$ and 50.0 ml of 0.36 M NaOH
- K_a for $\text{HC}_2\text{H}_3\text{O}_2$ 1.8×10^{-5}
- 3.00
 - 3.68
 - 4.74
 - 5.00
 - 6.00
21. Acid K_a
 H_3PO_4 7.2×10^{-3}
 H_2PO_4^- 6.3×10^{-8}
 HPO_4^{2-} 4.2×10^{-13}
 Using the information above, choose the best answer for preparing a buffer with $\text{pH} = 7$
- $\text{K}_2\text{HPO}_4 + \text{KH}_2\text{PO}_4$
 - H_3PO_4
 - $\text{K}_2\text{HPO}_4 + \text{K}_3\text{PO}_4$
 - K_3PO_4
 - $\text{K}_2\text{HPO}_4 + \text{H}_3\text{PO}_4$
22. A solution of a weak base is titrated with a solution of a standard strong acid. The progress of the titration is followed with a pH meter. Which of the following observations would occur?
- The pH of the solution gradually decreases throughout the experiment.
 - Initially the pH drops slowly, and then it drops much more rapidly.
 - At the equivalence point the pH is 7
 - After the equivalence point, the pH becomes constant because this is the buffer region.
 - The pOH at the equivalence point equals the $\text{p}K_a$ of the base.
23. You are given equimolar solutions of each of the following. Which has the lowest pH?
- NH_4Cl
 - NaCl
 - K_3PO_4
 - Na_2CO_3
 - KNO_3
24. When sodium nitrite is dissolved in water,
- The solution is acidic because of hydrolysis of the sodium ion.
 - The solution is neutral
 - The solution is basic because of hydrolysis of the sodium ion.
 - The solution is acidic because of hydrolysis of the NO_2^- ion.
 - The solution is basic because of hydrolysis of the NO_2^- ion.
25. Which of the solutions below would have a pH above 7
- NH_4NO_3
 - AlCl_3
 - KClO_4
 - K_2SO_3
 - HCl
26. The addition of nitric acid would increase the solubility of which of the following solid compounds?
- KCl
 - $\text{Pb}(\text{CN})_2$
 - $\text{Cu}(\text{NO}_3)_2$
 - NH_4NO_3
 - FeSO_4
27. Which statement below is true about the soluble salts listed below?
- KNO_3 forms a basic solution
 - NaCl forms an acidic solution
 - KClO forms a neutral solution
 - NH_4NO_3 forms a basic solution
 - Na_2CO_3 forms a basic solution

28. The equilibrium expression for the hydrolysis $C_2O_4^{2-}$ of is best represented by which of the following?

a.
$$K = \frac{[OH^-][C_2O_4^{2-}]}{[HC_2O_4^-]}$$

b.
$$K = \frac{[H_3O^+][C_2O_4^{2-}]}{[HC_2O_4^-]}$$

c.
$$K = \frac{[OH^-][HC_2O_4^-]}{[C_2O_4^{2-}]}$$

d.
$$K = \frac{[C_2O_4^{2-}]}{[HC_2O_4^-][OH^-]}$$

e.
$$K = \frac{[C_2O_4^{2-}]}{[HC_2O_4^-][H_3O^+]}$$

29. Which of the following procedures will produce a buffered solution?

- I. Equal volume of 0.5 M NaOH and 1 M HCl solutions are mixed.
- II. Equal volumes of 0.5 M NaOH and 1 M $HC_2H_3O_2$ solutions are mixed.
- III. Equal volumes of 1 M $NaC_2H_3O_2$ and 1 M $HC_2H_3O_2$ solutions are mixed.

- a. I only
- b. III only
- c. I and II only
- d. II and III only
- e. I, II, and III

30. A 0.5-molar solution of which of the following salts will have the lowest pH?

- a. KCl
- b. $Cu(NO_3)_2$
- c. NaI
- d. KNO_3
- e. $NaC_2H_3O_2$

31. Which of substances can act as a Lewis acid?

- I. Na^+
- II. Fe^{3+}
- III. Cl^-

- a. I only
- b. II only
- c. I and II only
- d. II and III only
- e. I, II, and III

32. Which statement is true for the reaction between boron trifluoride and ammonia?

- a. BF_3 is a Lewis acid.
- b. BF_3 is an Arrhenius base
- c. NH_3 is an Arrhenius base.
- d. NH_3 is a Bronsted-Lowry base
- e. NH_3 accepts a pair of electrons from BF_3

33. Temperature is often given with Ksp values because

- a. the solubility of solids always increases with increasing temperature.
- b. the solubility of solids varies with temperature changes.
- c. solubility changes with temperature but Ksp values do not.
- d. Ksp varies with temperature even though concentrations do not.
- e. the number of ions varies with the kind of salt that is dissolving.

34. The Ksp expression for silver phosphate is

- a. $K_{sp} = [Ag^+][PO_4^{3-}]$
- b. $K_{sp} = [Ag^+]^2[PO_4^{3-}]$
- c. $K_{sp} = [Ag^+]^3[PO_4^{3-}]$
- d. $K_{sp} = [Ag^+][PO_4^{3-}]^3$
- e. $K_{sp} = [Ag^+][PO_4^{3-}] / [Ag_3PO_4]$

35. The solubility of nickel(II) hydroxide, $K_{sp} = 1.6 \times 10^{-16}$, is about

- a. $\sqrt[3]{4.0 \times 10^{-17}}$
- b. $\sqrt[3]{\frac{1.6 \times 10^{-16}}{2}}$
- c. $\sqrt{1.6 \times 10^{-16}}$
- d. $\sqrt{(1.6 \times 10^{-16})(3)}$
- e. $\sqrt{(1.6 \times 10^{-16})(4)}$

36. The solubility of magnesium hydroxide ($K_{sp} = 8.0 \times 10^{-12}$) in a buffered solution of pH = 11.00 would be

- a. 1.0×10^{-11} M
- b. 8.0×10^{10} M
- c. 8.0×10^{-12} M
- d. 8.0×10^{-11} M
- e. 8.0×10^{-6} M

37. The solubility of silver sulfide is 8.0×10^{-17} M. Determine the K_{sp} of this salt.
- 64×10^{-51}
 - $(16.0 \times 10^{-17})(8.0 \times 10^{-17})$
 - $(16.0 \times 10^{-17})^2 (8.0 \times 10^{-17})$
 - $(8.0 \times 10^{-17})(4.0 \times 10^{-17})$
 - $(4.0 \times 10^{-17})^2 (8.0 \times 10^{-17})$
38. Equal volumes of 1.6×10^{-5} M KCl and 1.6×10^{-5} M AgNO_3 are mixed. the K_{sp} for silver chloride is 1.6×10^{-10} . As these two solutions intermingle,
- a precipitate of AgCl forms.
 - there is no precipitate formed.
 - NaCl will precipitate.
 - AgNO_3 will precipitate.
 - the $[\text{Na}^+]$ will become 0.020 M.
39. A saturated solution of a strong base, MOH, has a pH of 11.00, what is the K_{sp} for this base.
- 1.0×10^{-6}
 - 1.0×10^{-11}
 - 5.0×10^{-11}
 - 2.5×10^{-12}
 - 1.0×10^{-22}
40. The K_{sp} of the metal hydroxide, MOH, is 1.0×10^{-8} , what is the pH of a saturated solution of MOH?
- 4.00
 - 8.00
 - 10.00
 - 12.00
 - 14.00
41. What is the molar solubility in water of PbI_2 ?
(The K_{sp} for PbI_2 is 3.2×10^{-8})
- 3.2×10^{-8} M
 - 8.0×10^{-8} M
 - $(1.6)^{1/2} \times 10^{-8}$ M
 - $(1.6)^{1/3} \times 10^{-8}$ M
 - 2×10^{-3} M

Answer Key

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|----|---|----|---|
| 1 | d | 22 | b |
| 2 | c | 23 | a |
| 3 | e | 24 | e |
| 4 | e | 25 | d |
| 5 | d | 26 | b |
| 6 | b | 27 | e |
| 7 | a | 28 | c |
| 8 | a | 29 | d |
| 9 | b | 30 | b |
| 10 | e | 31 | b |
| 11 | c | 32 | a |
| 12 | a | 33 | b |
| 13 | b | 34 | c |
| 14 | c | 35 | a |
| 15 | e | 36 | e |
| 16 | b | 37 | c |
| 17 | d | 38 | b |
| 18 | b | 39 | a |
| 19 | e | 40 | c |
| 20 | d | 41 | e |
| 21 | a | | |